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AUTHOR Brannon, Yevonne S.; Clifford, William B.
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ABSTRACT

This report presents data analyzed by county and multicounty planning region which indicate that North Carolina's infant mortality rate has declined by 59 percent since 1940. (In 1940, approximately 58 infants for every 1,000 live births died in North Carolina before their first birthday.) This reduction in infant deaths is comparable to that experienced in the United States as a whole between 1940 and 1970; however, the North Carolina rate has remained consistently higher than the U.S. rate over the 30-year period. The North Carolina data showed considerable county-to-county variability in infant deaths. Thirty-four counties had rates of infant mortality in excess of the North Carolina rate. This finding was interpreted as an indication of inadequate health delivery systems in those counties. Regional analysis of data showed that many of the multicounty regions with the highest levels of infant mortality contain most of the rural counties of the state. Recommendations for further research into background factors involved in infant mortality are included. (Author/BRT)

Trends in Infant Mortality, North Carolina: 1940 to 1970

By

Yevonne S. Brannon and William B. Clifford

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J. C. Williamson, Jr., Director of Research

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FOREWORD

Rapid advances in the medical sciences, the changing patterns in health care and public health programs and the increased concern of agencies and the general public to meet the health needs of people necessitates constant evaluation of an area's health status. One indicator of the health status of an area is the level of infant mortality. In this report, the trends in infant mortality are presented for North Carolina, each county, and multi-county planning regions of the state. Hopefully, information of this type will be of use to those concerned with reducing infant mortality as well as improving health conditions of all people in North Carolina.

It is interesting to note that when the United States is compared with other industrialized nations, it has not achieved the lowest levels of infant mortality. The world leader in low infant mortality in 1970 was Sweden which had a rate of approximately 12.0 per 1,000 live births. The infant mortality rate in the United States at the same point in time was 20 per 1,000 live births. Even more striking is the fact ... North Carolina's rate (24) was higher than the national average rate. It is apparent that further reductions in infant death rates are possible in North Carolina and the United States.

We would like to express our appreciation to Dr. Selz C. Mayo, Head, Dr. A. Clarke Davis and Dr. R. David Mustian, of the Department of Sociology and Anthropology, for reading and providing helpful suggestions for the final draft of this report. The publication by C. Shannon Stokes and Craig R. Humphrey on Pennsylvania's population provides some of the seminal ideas which are incorporated in this report.

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TRENDS IN INFANT MORTALITY, NORTH CAROLINA: 1940 TO 1970*

Yevonne S. Brannon William B. Clifford

INTRODUCTION

Increasing interest in recent years to high rates of population growth and the control of fertility has often obscured interest in mortality. Yet, death remains a subject of deep concern to the person, to the family, and the community. The reduction of death rates still remains a major human goal. Consequently good health is an important value in the scale of those things that modern Americans consider to be of primary importance in their lives.

A constructive investigation of the health status of a population must attempt to answer three questions: What conditions exist? Why do they exist? How can they be improved? The second and third questions cannot be approached until the first is answered. Therefore, the first question will be the focus of this report.

To address the first question, data on infant mortality will be utilized. Infant mortality represents not only a tragic event for families, but also a sign of health conditions in a locality. It has been suggested that the level of a community's infant mortality rate has been a rough but usable measure of that community's level of living and the state of its social and economic development.[1] The great

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*Yevonne S. Brannon is a Teaching Assistant and William B. Clifford is an Associate Professor in the Department of Sociology and Anthropology.

[1]T. Lynn Smith and Paul E. Zopf, Jr., Demography: Principles and Methods, Philadelphia: F. A. Davis Company, 1970, p. 394. Calvin Goldscheider, Population, Modernization, and Social Structure, Boston: Little, Brown and Company, 1971, p. 124. Edward Stockwell, Population and People, Chicago: Quadrangle Books, 1968, p. 38.

sensitivity of the infant mortality rate to the socio-economic conditions existing in a community reflects the health of infants as well as their parents and the quality of residential environments.

Infant mortality has been affected rather quickly and directly by specific health programs directed toward the problem of infant death. Therefore, the reduction in the overall level of mortality in recent decades has largely occurred as a result of the control of infant mortality.

There was a significant decline in infant mortality in the United States as a whole as well as in each state from 1900-1950. Since 1950 there has been a noted deceleration in the rate of decline with little progress being achieved by 1970 in the reduction of the number of infant deaths. Even with the reductions in infant mortality achieved, the deaths of children less than one year of age continue to constitute a large proportion of all deaths such that the rate of deaths during the first year of life are not reached again until the approximate age of 65. It is clear that a major health problem still exists.

The State of North Carolina has been losing approximately 2,000 infants annually since 1970 as a result of death during the first year of life. Because any infant mortality is significant, this report focuses on the problem of infant deaths in the state. This examination of infant mortality will have a twofold purpose: first, to measure the differences in infant mortality that exist; and second, to identify those areas which have not fully shared in the gains achieved in reducing infant mortality. Therefore, infant mortality is examined for each county and planning region, and for the state as a whole for each census year since 1940. In this way a comprehensive picture of trends and differentials over the past three decades is presented.

STATE TRENDS, 1940-1970

In 1940, the infant mortality rate in North Carolina was 57.9 deaths per 1,000 live births compared to the United States rate of 46.6[2] (Figure 1 and Table 1). As shown below, North Carolina's rates of infant mortality have been consistently above those for the entire country. Nevertheless, both have experienced significant declines.

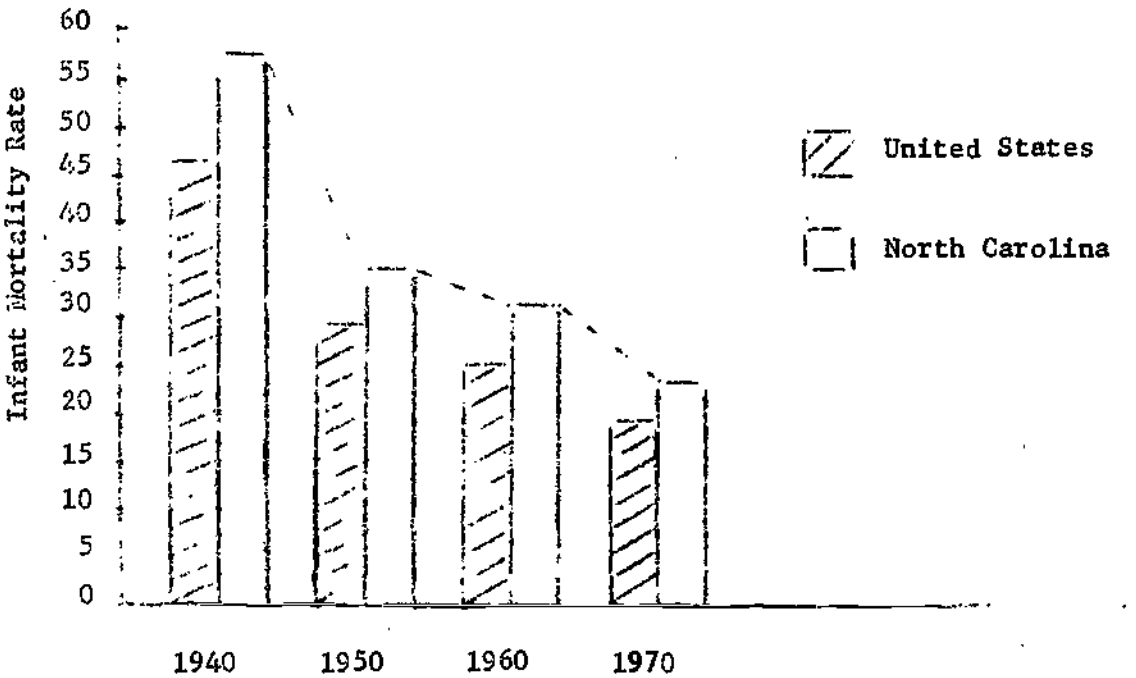

Figure 1. Infant mortality rates for North Carolina and the United States, 1940, 1950, 1960 and 1970

[2]The infant mortality rate is the number of infant deaths (under one year of age) per 1,000 live births. In this report, the number of infant deaths by place of residence was obtained by taking a three-year average centered around the census years. For more information concerning this procedure, see: G. W. Barclay, Techniques of Population Analysis, New York: John Wiley and Sons, 1958, pp. 137-144.

The Decade of the Forties

A sizable reduction in infant mortality occurred during the decade between 1940 and 1950. North Carolina, like the United States as a whole experienced larger absolute and relative declines during this decade than in the succeeding 20 years (Figures 2 and 3 and Table 2). By 1950, North Carolina's infant mortality rate was 35.1 as compared to the national rate of 29.6. For North Carolina, this represented an absolute decrease of 22.8 deaths per 1,000 live births over the decade, and a relative decline of approximately forty percent (39.4). The comparable figures for the United States are an absolute decrease of 17.0 deaths per 1,000 live births and a relative decrease of 36.5 percent. It is apparent that North Carolina experienced greater gains than the United States during this period but the rates remained at a higher level.

The Decade of the Fifties

The decade between 1950-1960 produced a much smaller decline in the infant mortality rate, both absolutely and relatively in North Carolina and the United States. The absolute decline for North Carolina was 3.4 deaths per 1,000 live births and the relative decline was 9.7 percent. In the same time period, the United States experienced a decline of 3.7 deaths per 1,000 live births representing a decline of 12.5 percent. Although the declines for both North Carolina and the United States were comparable, the rate for North Carolina continued to exceed that for the country as a whole.

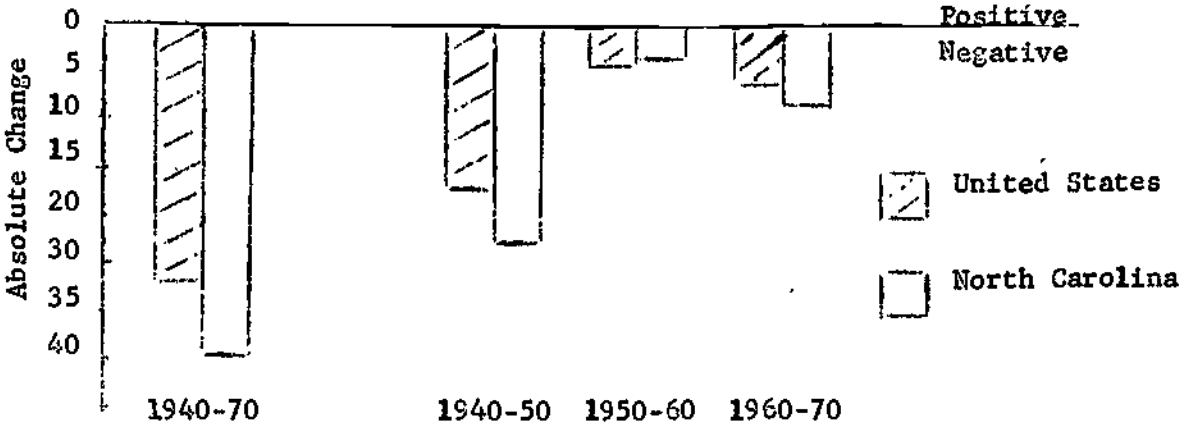

Figure 2. Absolute change in infant mortality rates for North Carolina and the United States, 1940-1970

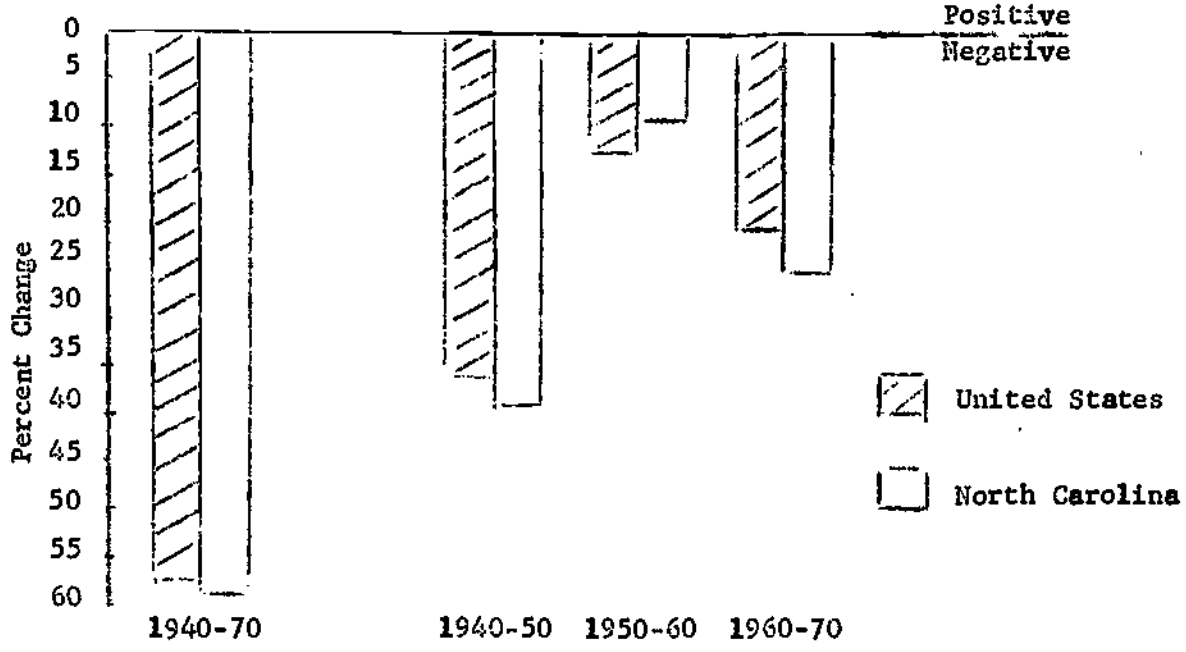

Figure 3. Percent change in infant mortality rates for North Carolina and the United States, 1940-1970

The Decade of the Sixties

During the past decade, 1960 to 1970, North Carolina as well as the United States as a whole experienced greater absolute and percentage declines than were evident during the previous decade. The state rate declined from 31.7 in 1960 to 23.7 in 1970. For the same years the rates for the United States were 25.9 and 19.9, respectively. The absolute decline of 8.0 deaths per 1,000 live births for North Carolina and 6.0 for the United States was larger than the 1950-1960 decline. The percent decline for the decade, 25.2 for North Carolina and 23.2 for the United States, represented the greatest reduction in infant mortality since the 1940-1950 decade.

Thirty-Year Trends

Comparing the infant mortality in 1940 and 1970 demonstrates the significant gains in reducing mortality among infants. Over the thirty-year period, infant mortality in North Carolina has been reduced 34.2 deaths per 1,000 live births, representing a decline of 59.1 percent. In the United States, the decline was 26.7 deaths per 1,000 live births and a relative decline of 57.2 percent. Instead of more than fifty infants in each 1,000 dying before their first birthday as in 1940, less than 25 died in North Carolina in 1970. However, it should be noted that at least 45 states have lower infant mortality rates than North Carolina.[3] This suggests that perhaps with additional health

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[3]The 1969-1970 average rates of infant mortality by place of occurrence were used for these comparisons. The data were obtained from: National Center for Health Statistics, Monthly Vital Statistics Reports, Annual Summary for the United States, 1970 (Provisional), Births, Deaths, Marriages, and Divorces, Vol. 19 (September 21, 1971).

care North Carolina's present rate could be reduced even more. Nonetheless, the thirty-year decline of 59 percent for the state is significant and is cause for optimism.

Table 1. Infant mortality rates for North Carolina counties, 1940-1970*

County	1940	1950	1960	1970
	(Per 1,000 Live Births)			
Alamance	32.2	24.8	24.0	22.4
Alexander	35.3	29.8	28.5	29.6
Alleghany	70.8	20.6	29.3	28.6
Anson	57.6	38.9	39.0	39.2
Ashe	62.0	38.8	23.6	14.0
Avery	55.4	19.5	30.9	26.6
Beaufort	89.0	54.3	43.4	26.6
Bertie	86.0	43.9	47.7	31.1
Bladen	66.3	50.0	35.9	25.7
Brunswick	65.1	34.4	35.9	18.5
Buncombe	58.1	32.0	26.7	24.1
Burke	32.4	18.6	24.5	23.1
Cabarrus	57.7	26.2	26.2	18.3
Caldwell	53.8	29.9	35.3	26.9
Camden	91.8	36.2	14.0	34.2
Carteret	64.5	29.1	31.9	22.2
Caswell	43.9	38.0	45.3	27.5
Catawba	49.0	29.3	25.9	24.5
Chatham	45.2	33.6	29.3	14.6
Cherokee	41.2	41.8	39.8	25.1
Chowan	76.2	46.9	40.6	23.1
Clay	66.7	23.5	17.0	41.1
Cleveland	44.3	27.6	32.3	31.2
Columbus	72.9	41.4	46.2	26.4
Craven	72.7	34.0	31.7	22.0
Cumberland	56.9	33.7	25.5	22.4
Currituck	81.9	45.6	55.0	7.3
Dare	45.3	34.0	34.3	18.2
Davidson	54.5	33.5	34.0	26.5
Davie	60.5	32.9	26.2	10.2
Duplin	64.4	43.9	38.5	22.6
Durham	55.9	26.7	28.5	20.3
Edgecombe	77.9	48.5	41.5	30.1
Forsyth	62.8	29.8	29.6	17.0
Franklin	71.1	37.7	43.3	30.8
Gaston	53.6	27.9	28.4	22.9
Gates	69.6	45.1	26.6	32.5
Graham	53.7	51.3	21.2	13.9

Table 1. (Continued)

County	1940	1950	1960	1970
	(Per 1,000 Live Births)			
Granville	51.7	42.0	34.4	29.6
Greene	48.7	38.5	38.5	51.5
Guilford	45.1	27.9	30.6	22.5
Halifax	61.2	49.1	41.1	31.6
Harnett	60.0	29.4	36.4	29.0
Haywood	48.6	26.0	27.8	25.2
Henderson	51.3	35.9	23.3	23.2
Hertford	71.0	45.0	37.2	33.7
Hoke	57.4	46.4	39.6	29.3
Hyde	47.8	24.0	46.0	48.8
Iredell	65.2	38.5	29.3	27.7
Jackson	67.5	28.4	25.5	19.7
Johnston	48.9	37.6	31.0	27.5
Jones	65.1	44.9	61.4	20.3
Lee	52.4	37.2	44.0	20.0
Lenoir	68.6	47.5	37.1	24.1
Lincoln	56.2	33.3	31.2	20.1
McDowell	45.0	23.1	23.1	21.7
Macon	51.4	38.9	25.4	17.5
Madison	58.2	34.0	30.2	27.4
Martin	58.3	34.2	43.2	28.3
Mecklenburg	52.3	33.6	30.4	22.3
Mitchell	42.8	26.0	26.5	16.5
Montgomery	34.1	25.4	37.5	29.7
Moore	41.9	27.1	29.5	27.2
Nash	63.6	46.1	37.7	25.2
New Hanover	54.9	34.4	32.1	22.3
Northampton	44.9	31.0	45.6	25.2
Onslow	81.0	39.0	26.4	23.3
Orange	49.3	23.0	26.2	15.0
Pamlico	56.6	49.2	29.7	28.6
Pasquotank	76.9	40.2	32.7	21.7
Pender	55.9	38.4	35.3	16.6
Perquimans	52.1	42.6	24.3	21.5
Person	47.4	24.3	32.1	24.0
Pitt	72.4	40.1	38.2	30.5
Polk	45.7	42.2	13.0	27.7
Randolph	40.5	31.8	27.3	18.4
Richmond	66.9	38.7	35.7	30.2
Robeson	64.3	49.1	40.7	26.8
Rockingham	60.6	32.6	23.4	30.0
Rowan	50.1	33.6	23.2	17.2
Rutherford	46.3	25.3	32.2	26.8
Sampson	63.8	35.9	40.2	21.6
Scotland	80.7	51.5	34.3	32.0

Table 1. (Continued)

County	1940	1950	1960	1970
	Per 1,000 Live Births)			
Stanly	46.9	26.0	27.6	21.7
Stokes	59.8	28.1	18.1	22.1
Surry	60.1	32.3	28.2	25.2
Swain	41.1	29.9	20.7	13.4
Transylvania	49.4	20.0	25.1	29.9
Tyrrell	57.2	59.6	67.5	28.6
Union	52.4	37.9	37.9	21.1
Vance	64.8	45.7	40.9	25.7
Wake	61.5	36.3	30.1	19.7
Warren	96.0	43.1	48.6	31.6
Washington	70.0	52.5	41.7	43.0
Watauga	51.4	25.2	26.1	22.9
Wayne	79.0	37.0	31.2	21.4
Wilkes	48.1	29.7	29.1	28.8
Wilson	73.3	52.7	31.7	26.6
Yadkin	45.8	16.9	36.7	20.0
Yancey	52.0	22.0	21.5	26.9
NORTH CAROLINA	57.9	35.1	31.7	23.7
UNITED STATES	46.6	29.6	25.9	19.9

*All data are by place of residence.

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Table 2. Absolute and percent change in infant mortality rates for North Carolina counties, 1940-70

County	1940-50 Change in Rate		1950-60 Change in Rate		1960-70 Change in Rate		1940-70 Change in Rate	
	Absolute	Percent	Absolute	Percent	Absolute	Percent	Absolute	Percent
Alamance	-7.4	-23.0	-0.8	-3.2	-1.6	-6.7	-9.8	-30.4
Alexander	-5.5	-15.6	-1.3	-4.4	+1.1	+3.9	-5.7	-16.1
Alleghany	-50.2	-70.9	+8.7	+42.2	-0.7	-2.4	-42.2	-59.6
Anson	-18.7	-32.5	+0.1	+0.3	+0.2	+0.5	-18.4	-31.9
Ashe	-23.2	-37.4	-15.2	-39.2	-9.6	-40.7	-48.0	-77.4
Avery	-35.9	-64.8	+11.4	+58.5	-4.3	-13.9	-28.8	-52.0
Beaufort	-34.7	-39.0	-10.9	-20.1	-16.8	-38.7	-62.4	-70.1
Bertie	-42.1	-49.0	+3.8	+8.7	-16.6	-34.8	-54.9	-63.8
Bladen	-16.3	-24.6	-14.1	-28.2	-10.2	-28.4	-40.6	-61.2
Brunswick	-30.7	-47.2	+1.5	+4.4	-17.4	-48.5	-46.6	-71.6
Buncombe	-26.1	-44.9	-5.3	-16.6	-2.6	-9.7	-34.0	-58.5
Burke	-13.8	-42.6	+5.9	+31.7	-1.4	-5.7	-9.3	-28.7
Cabarrus	-31.5	-54.6	0	-	-7.9	-30.2	-39.4	-68.3
Caldwell	-23.9	-44.4	+5.4	+18.1	-8.4	-23.8	-26.9	-50.0
Camden	-55.6	-60.6	-22.2	-61.3	+20.2	+144.3	-57.6	-62.7
Carteret	-35.4	-54.9	+2.8	+9.6	-9.7	-30.4	-42.3	-65.6
Caswell	-5.9	-13.4	+7.3	+19.2	-17.8	-39.3	-16.4	-37.4
Catawba	-19.7	-40.2	-3.4	-11.6	-1.4	-5.4	-24.5	-50.0
Chatham	-11.6	-25.7	-4.3	-12.8	-14.7	-50.2	-30.6	-67.7
Cherokee	+0.6	+1.5	-2.0	-4.8	-14.7	-36.9	-16.1	-39.1
Chowan	-29.3	-38.5	-6.3	-13.4	-17.5	-43.1	-53.1	-69.7
Clay	-43.2	-64.8	-6.5	-27.7	+24.1	+141.8	-25.6	-38.4
Cleveland	-16.7	-37.7	+4.7	+17.0	-1.1	-3.4	-13.1	-29.6
Columbus	-31.5	-43.2	+4.8	+11.6	-19.8	-42.9	-46.5	-63.8
Craven	-38.7	-53.2	-2.3	-6.8	-9.7	-30.6	-50.7	-69.7
Cumberland	-23.2	-40.8	-8.2	-24.3	-3.1	-12.2	-34.5	-60.6

Table 2. (Continued)

County	1940-50 Change in Rate		1950-60 Change in Rate		1960-70 Change in Rate		1940-70 Change in Rate	
	Absolute	Percent	Absolute	Percent	Absolute	Percent	Absolute	Percent
Currituck	-36.3	-44.3	+9.4	+20.6	-47.7	-86.7	-74.6	-91.1
Dare	-11.3	-24.9	+0.3	+0.9	-16.1	-46.9	-27.1	-59.8
Davidson	-21.0	-38.5	+0.5	+1.5	-7.5	-22.1	-28.0	-51.4
Davie	-27.6	-45.6	-6.7	-20.4	-16.0	-61.1	-50.3	-83.1
Duplin	-20.5	-31.8	-5.4	-12.3	-15.9	-41.3	-41.8	-64.9
Durham	-29.2	-52.2	+1.8	+6.7	-8.2	-28.8	-35.6	-63.7
Edgecombe	-29.4	-37.7	-7.0	-14.4	-11.4	-27.5	-47.8	-61.4
Forsyth	-33.0	-52.5	-0.2	-0.7	-12.6	-42.6	-45.8	-72.9
Franklin	-33.4	-47.0	+5.6	+14.9	-12.5	-28.9	-40.3	-56.7
Gaston	-25.7	-47.9	+0.5	+1.8	-5.5	-19.4	-30.7	-57.3
Gates	-24.5	-35.2	-18.5	-41.0	+5.9	+22.2	-37.1	-53.3
Graham	-22.4	-41.7	-10.1	-32.3	-7.3	-34.4	-39.8	-74.1
Granville	-9.7	-18.8	-7.6	-18.1	-4.8	-14.0	-22.1	-42.7
Greene	-10.2	-20.9	0	-	+13.0	+33.8	+2.8	+5.7
Guilford	-17.2	-38.1	+2.7	+9.7	-8.1	-26.5	-22.6	-50.1
Halifax	-12.1	-19.8	-8.0	-16.3	-9.5	-23.1	-29.6	-48.4
Harnett	-30.6	-51.0	+7.0	+23.8	-7.4	-20.3	-31.0	-51.7
Haywood	-22.6	-46.5	+1.8	+6.9	-2.6	-9.4	-23.4	-48.1
Henderson	-15.4	-30.0	-12.6	-35.1	-0.1	-0.4	-28.1	-54.8
Hertford	-26.0	-36.6	-7.8	-17.3	-3.5	-9.4	-37.3	-52.5
Hoke	-11.0	-19.2	-6.8	-14.7	-10.3	-26.0	-28.1	-49.0
Hyde	-23.8	-49.8	+22.0	+91.7	+2.8	+6.1	+1.0	+2.1
Iredell	-26.7	-41.0	-9.2	-23.9	-1.6	-5.5	-37.5	-57.5
Jackson	-39.1	-57.9	-2.9	-10.2	-5.8	-22.7	-47.8	-70.8
Johnston	-11.3	-23.1	-6.6	-17.6	-3.5	-11.3	-21.4	-43.8
Jones	-20.2	-31.0	+16.5	+36.7	-41.1	-66.9	-44.8	-68.8
Lee	-15.2	-29.0	+6.8	+18.3	-24.0	-54.5	-32.4	-61.8
Lenoir	-21.1	-30.8	-10.4	-21.9	-13.0	-35.0	-44.5	-64.9

Table 2. (Continued)

County	1940-50 Change in Rate		1950-60 Change in Rate		1960-70 Change in Rate		1940-70 Change in Rate	
	Absolute	Percent	Absolute	Percent	Absolute	Percent	Absolute	Percent
Lincoln	-22.9	-40.7	-2.1	-6.3	-11.1	-35.6	-36.1	-64.2
McDowell	-21.9	-48.7	0	-	-1.4	-6.1	-23.3	-51.8
Macon	-12.5	-24.3	-13.5	-34.7	-7.9	-31.1	-33.9	-66.0
Madison	-24.2	-41.6	-3.8	-11.2	-2.8	-9.3	-30.8	-52.9
Martin	-24.1	-41.3	+9.0	+26.3	-14.9	-34.5	-30.0	-51.5
Mecklenburg	-18.7	-35.8	-2.7	-8.0	-8.6	-27.8	-30.0	-57.4
Mitchell	-16.8	-39.3	+0.5	+1.9	-10.0	-37.7	-26.3	-61.4
Montgomery	-8.7	-25.5	+12.1	+47.6	-7.8	-20.8	-4.4	-12.9
Moore	-14.8	-35.3	+2.4	+8.9	-2.3	-7.8	-14.7	-35.1
Nash	-17.5	-27.5	-8.4	-18.2	-12.5	-33.2	-38.4	-60.4
New Hanover	-20.5	-37.3	-2.3	-6.7	-9.8	-30.5	-32.6	-59.4
Northampton	-13.9	-31.0	+14.6	+47.1	-20.4	-44.7	-19.7	-43.9
Onslow	-42.0	-51.9	-12.6	-32.3	-3.1	-11.7	-57.7	-71.2
Orange	-26.3	-53.3	+3.2	+13.9	-11.2	-42.7	-34.3	-69.6
Pamlico	-7.4	-13.1	-19.5	-39.6	-1.1	-3.7	-28.0	-49.5
Pasquotank	-36.7	-47.7	-7.3	-18.2	-11.0	-33.6	-55.2	-71.8
Pender	-17.5	-31.3	-3.1	-8.1	-18.7	-53.0	-39.3	-70.3
Perquimans	-9.5	-18.2	-18.3	-43.0	-2.8	-11.5	-30.6	-58.7
Person	-23.1	-48.7	+7.8	+32.1	-8.1	-25.2	-23.4	-49.4
Pitt	-32.3	-44.6	-1.9	-4.7	-7.7	-20.2	-41.9	-57.9
Polk	-3.5	-7.7	-29.2	-69.2	+14.7	+113.1	-18.0	-39.4
Randolph	-8.7	-21.5	-4.5	-14.2	-8.9	-32.6	-22.1	-54.6
Richmond	-28.2	-42.2	-3.0	-7.8	-5.5	-15.4	-36.7	-54.9
Robeson	-15.2	-23.6	-8.4	-17.1	-13.9	-34.2	-37.6	-58.3
Rockingham	-28.0	-46.2	-9.2	-28.2	+6.6	+28.2	-30.6	-50.5
Rowan	-16.5	-32.9	-10.4	-31.0	-6.0	-25.9	-32.9	-65.7
Rutherford	-21.0	-45.4	+6.9	+29.3	-5.4	-16.8	-19.5	-42.1

Table 2. (Continued)

County	1940-50 Change in Rate		1950-60 Change in Rate		1960-70 Change in Rate		1940-70 Change in Rate	
	Absolute	Percent	Absolute	Percent	Absolute	Percent	Absolute	Percent
Sampson	-27.9	-43.7	+4.3	+12.0	-18.6	-46.3	-42.2	-66.1
Scotland	-29.2	-36.2	-17.2	-33.4	-2.3	-6.7	-48.7	-60.3
Stanly	-20.9	-44.6	+1.6	+6.2	-5.9	-21.4	-25.2	-53.7
Stokes	-31.7	-53.0	-10.0	-35.6	+4.0	+22.1	-37.7	-63.0
Surry	-27.8	-46.3	-4.1	-12.7	-3.0	-10.6	-34.9	-58.1
Swain	-11.2	-27.3	-9.2	-30.8	-7.3	-35.3	-27.7	-67.4
Transylvania	-29.4	-59.5	+5.1	+25.5	+4.8	+19.1	-19.5	-39.5
Tyrrell	+2.4	+4.2	+7.9	+13.3	-38.9	-57.6	-28.6	-50.0
Union	-14.5	-27.7	0	-	-16.8	-44.3	-31.3	-59.7
Vance	-19.1	-29.5	-4.8	-10.5	-15.2	-37.2	-39.1	-60.3
Wake	-25.2	-41.0	-6.2	-17.1	-10.4	-34.6	-41.8	-68.0
Warren	-5299	-55.1	+5.5	+12.8	-17.0	-35.0	-64.4	-67.1
Washington	-1755	-25.0	-10.8	-20.6	+1.3	+3.1	-27.0	-38.6
Watauga	-26.2	-51.0	+0.9	+3.6	-3.2	-12.3	-28.5	-55.4
Wayne	-42.0	-53.2	-5.8	-15.7	-9.8	-31.4	-57.6	-72.9
Wilkes	-18.4	-38.3	-0.6	-2.0	-0.3	-1.0	-19.3	-40.1
Wilson	-20.6	-28.1	-21.0	-39.8	-5.1	-16.1	-46.7	-63.7
Yadkin	-28.9	-63.1	+19.8	+117.2	-16.7	-45.5	-25.8	-56.3
Yancey	-30.0	-57.7	-0.5	-2.3	+5.4	+25.1	-25.1	-48.3
North Carolina	-22.8	-39.4	-3.4	-9.7	-8.0	-25.2	-34.2	-59.1
United States	-17.0	-36.4	-3.7	-12.5	-6.0	-20.1	-26.7	-57.2

Sources: Ibid.

COUNTY DIFFERENTIALS AND TRENDS

1940

Looking at only the total state rate obscures the wide differentials in infant mortality among counties. Table 3 presents indices of relative mortality for each county for each censal year. County rates are expressed as a percent of the state rate for that year. If the number is above 100, the county rate is higher than the state rate; if it is below 100, the county rate is lower. If it is exactly 100, the county and the state rates are equal. For example, in 1940, Caswell County had an index of 76. This means that Caswell County's infant mortality rate was 24 percent lower than the overall North Carolina rate. The last entry in Table 3, the range, is merely the highest index minus the lowest.[4] For 1940, the range was equal to 110, produced by the 166 for Warren County minus the 56 for Alamance County.

In 1940, twenty of the 100 counties had infant mortality rates 20 percent or more above the North Carolina rate. Four of these counties, Bertie, Edgecombe, Warren and Washington, had consistently above average rates through 1970. There were 19 counties which had rates twenty percent or more below the North Carolina rate in 1940. It is interesting to note that none of these counties had consistently below average rates through 1970; however, 8 counties -- Alamance, Burke, Chatham, Guilford, Mitchell, McDowell, Randolph and Swain -- did have rates below the state rate throughout the thirty-year period.

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[4] Since many of the county rates of infant mortality are based on a small number of cases, an adjusted range is also included in Table 3. The adjusted range is more realistic in that it utilizes the highest and lowest indices of those counties which have an adequate number of cases.

Since many of the counties with infant mortality rates considerably above and below the state rate are basically rural, it is apparent that other factors such as socioeconomic background, access to medical services, etc., may be affecting the rates. In addition, it may be a combination of these factors along with residence that affects the level of infant mortality.

1950

In 1950, twenty-five counties had rates twenty percent or more above the North Carolina rate, five more than in 1940. Only eleven of these counties had above average rates in the previous time period. There were twenty-five counties approximately twenty percent or more below the state rate in 1950. This was 6 counties more than the 19 such counties in 1940. Moreover, only ten of the twenty-five counties were in this group in 1940. The adjusted range of 102 obtained by comparing the indices of Burke County (53) and Beaufort County (155), were somewhat lower than the range of 110 in 1940.

1960

The range in infant mortality increased over the 1950 to 1960 decade even though rates were declining. Using the high index of 213 for Tyrrell County and the low index of 41 for Polk, a range of 172 is obtained. The adjusted range, obtained by comparing Rowan County (73) with Jones County (194) is 121 and obviously exceeds the adjusted range of 102 observed in 1950. The infant mortality rates for Jones and Rowan Counties were 61.4 and 23.2 respectively. The number of counties twenty percent or more below the state average decreased from 25 to 17

over the preceding decade and the number of counties 20 percent or more above increased slightly from 25 to 27.

In terms of numbers of deaths as well as rates, some counties exhibit rather erratic patterns over the time period being considered. For example, in Cleveland County, the infant mortality rate decreased during the 1940-50 decade, increased during the 1950-60 decade, and decreased again during the 1960-70 decade. The state pattern during this time was one of continued decline. Greene County also provides a striking contrast to the state pattern of change where in 1940 this county was 16 percent below the state rate, 21 percent above the state rate in 1960, and 117 above in 1970. During the 1960-70 decade, the infant mortality rate for Greene County increased 33.8 percent, while the state rate declined 25.2 percent. The reasons for the variations in these and other counties are not readily apparent, but warrant further attention by local health officials.

1970

In 1970, 28 counties had rates twenty percent or more above the state rate. Yet, in 1970, there were only 16 counties twenty percent or more below the state rate as compared to 25 in 1950 and 17 in 1960. The adjusted range was 92. This figure was obtained by subtracting Rowan's index of 73 from Anson County's index of 165. It is also interesting to note that the adjusted range observed in 1970 represents a significant reduction from that evident in earlier time periods. After adjusting for small bases, there were only 8 counties that had rates 30-50 percent above the state rate in 1960 and 1970. In past periods the number of counties with rates that high was considerably larger.

Table 3. Indices of relative infant mortality for North Carolina counties, 1940-1970

County	1940	1950	1960	1970
Alamance	56	71	76	95
Alexander	61	85	90	125
Alleghany	122	57	92	121
Anson	99	111	123	165
Ashe	107	111	74	59
Avery	96	56	97	112
Beaufort	153	155	137	112
Bertie	148	125	150	131
Bladen	114	142	113	108
Brunswick	112	98	113	78
Buncombe	100	91	84	102
Burke	56	53	77	97
Cabarrus	100	75	83	77
Caldwell	93	85	112	114
Camden	158	103	44	146
Carteret	111	83	101	94
Caswell	76	108	143	116
Catawba	84	83	82	104
Chatham	78	93	92	62
Cherokee	71	119	126	106
Chowan	101	134	128	98
Clay	115	67	54	174
Cleveland	77	79	103	132
Columbus	126	118	146	112
Craven	125	97	100	93
Cumberland	98	96	81	94
Currituck	141	130	174	31
Dare	78	97	108	77
Davidson	94	95	107	112
David	104	94	83	43
Duplin	111	125	122	95
Durham	96	76	90	86
Edgecombe	134	138	131	127
Forsyth	108	85	93	72
Franklin	123	108	137	130
Gaston	92	80	90	97
Gates	120	129	84	137
Graham	93	89	67	59
Granville	89	120	109	125
Greene	84	110	121	217
Guilford	78	80	96	95
Halifax	106	140	130	134
Harnett	104	84	115	122

Table 3. (Continued)

County	1940	1950	1960	1970
Haywood	84	74	88	106
Henderson	89	102	74	98
Hertford	123	128	117	142
Hoke	99	132	125	124
Hyde	82	68	145	206
Iredell	112	110	93	117
Jackson	117	81	80	83
Johnston	84	107	98	116
Jones	112	128	194	86
Lee	90	106	140	85
Lenoir	118	135	117	102
Lincoln	97	95	99	85
McDowell	78	66	73	92
Macon	89	110	80	74
Madison	101	97	95	116
Martin	101	112	136	119
Mecklenburg	90	96	97	94
Mitchell	74	76	84	70
Montgomery	59	73	118	126
Moore	72	77	93	115
Nash	110	132	119	106
New Hanover	95	98	101	94
Northampton	78	105	144	107
Onslow	140	111	83	98
Orange	85	66	83	63
Pamlico	98	140	94	121
Pasquotank	133	115	103	92
Pender	96	110	111	70
Perquimans	90	121	77	91
Person	82	69	101	102
Pitt	125	114	121	129
Polk	79	120	41	117
Randolph	70	91	86	78
Richmond	116	110	113	128
Robeson	111	140	128	113
Rockingham	105	93	74	127
Rowan	86	96	73	73
Rutherford	80	72	102	113
Sampson	110	102	127	91
Scotland	139	147	108	135
Stanley	81	74	87	92
Stokes	129	71	57	93
Surry	104	92	89	106
Swain	71	85	65	57
Transylvania	85	57	79	126
Tyrrell	99	170	213	121
Union	90	108	120	89

Table 3. (Continued)

County	1940	1950	1960	1970
Vance	112	130	129	109
Wake	106	103	95	83
Warren	166	123	153	133
Washington	121	150	132	182
Watauga	89	72	82	97
Wayne	136	105	99	90
Wilkes	83	85	92	122
Wilson	126	150	100	112
Yadkin	79	48	116	85
Yancey	90	63	68	114
Range	110	122	172	186
Range Adjusted for Small Numbers	--	102	121	92

Sources: Ibid.

INFANT MORTALITY IN THE MULTI-COUNTY PLANNING REGIONS

There is much interest in the adequacy of health delivery systems in the planning regions of North Carolina. Since infant mortality, as noted earlier, is both an important indicator and component of community health, data are reported for the seventeen planning regions of the state. The map, Figure 4, is provided to show counties in each planning region. By considering patterns of infant mor lity by planning regions for the period 1940-1970, the changing incidence of infant mortality is evident.

Regional Levels in Infant Mortality, 1940-1970

As shown in Table 4, the highest infant mortality rates occurred in Regions M (69.1), P (69.0), and Q (75.8) in 1940. These planning regions were considerably above the state rate of 57.9. Other planning regions with relatively high rates of infant mortality were R, N, O, K, and L. These regions included some of the most rural areas of North Carolina in 1940 and were located in the eastern sector of the state with the exception of planning region K which is located in the Piedmont.

Infant mortality rates considerably below the North Carolina average were experienced by planning regions C (45.2) and E (44.8). The remaining planning regions were also below the state average but are less distinctive in that they fall close to the state rate.

By 1950, differences between planning regions were slightly more distinctive with the range being 64 among the seventeen planning regions. Seven planning regions still had infant mortality in excess of the state average, although the actual infant mortality rates for all of the planning regions had been reduced during the 1940-1950 decade. Regions C and E

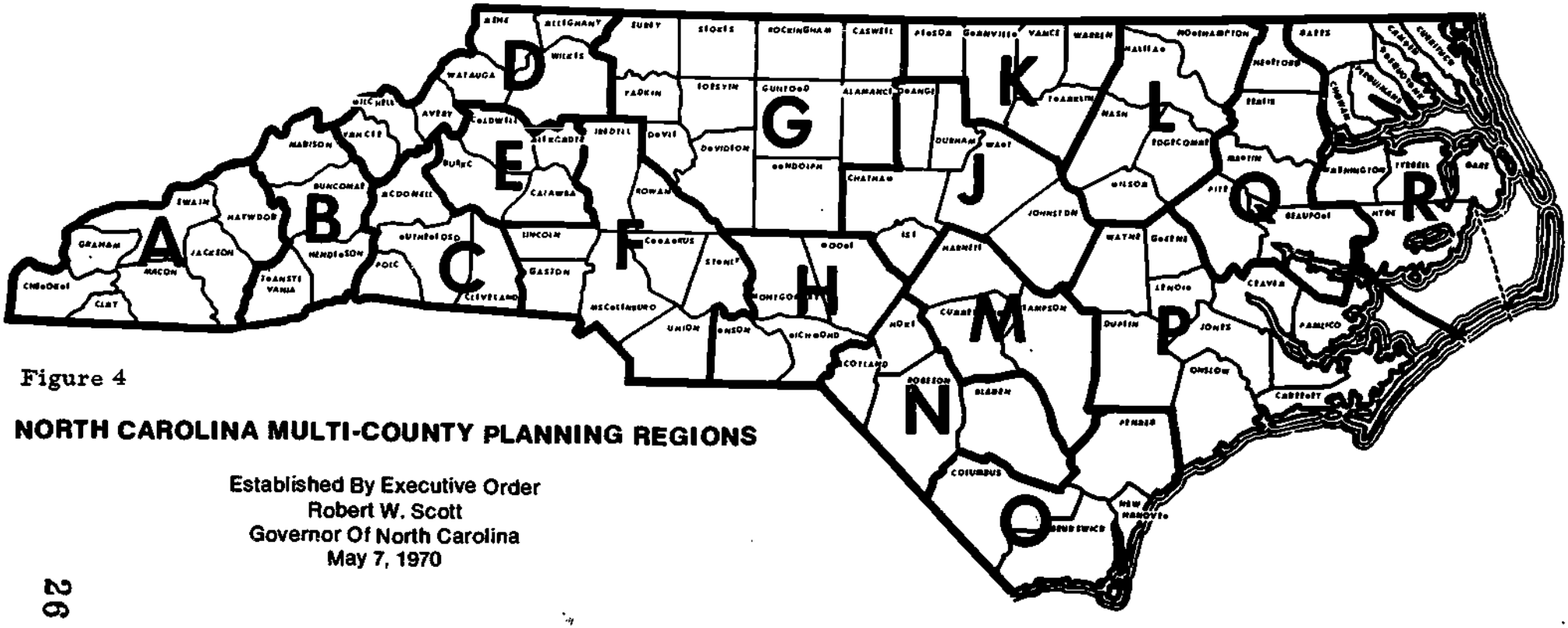

Figure 4

NORTH CAROLINA MULTI-COUNTY PLANNING REGIONS

Established By Executive Order
Robert W. Scott
Governor Of North Carolina
May 7, 1970

still had the lowest rates with both being 33 percent below the state average. With the exception of four multi-county regions -- D, M, L and N -- the planning regions remained relatively constant in relation to the state rate. For example, the index number for planning region A in 1940 was 88 compared with an index number of 89 in 1950.

Table 4. Infant mortality rates for North Carolina planning regions, 1940-1970

Planning Region	1940	1950	1960	1970
	(Per 1,000 Live Births)			
A	51.0	31.1	27.1	21.9
B	55.3	31.8	26.2	24.7
C	45.2	27.1	29.5	28.0
D	52.3	27.8	27.0	23.9
E	44.8	26.9	28.3	25.3
F	54.0	32.1	29.5	21.9
G	51.4	29.6	29.1	21.9
H	53.5	33.7	34.6	31.8
J	54.4	33.0	30.3	20.0
K	65.7	38.9	41.0	27.8
L	65.4	47.0	38.8	28.0
M	69.1	33.3	29.3	23.2
N	66.2	49.4	38.8	27.8
O	63.6	37.5	37.5	22.3
P	69.0	39.4	32.3	23.6
Q	75.8	44.0	41.0	29.9
R	67.8	43.5	36.2	27.7
North Carolina	57.9	35.1	31.7	23.7
United States	46.6	29.6	25.9	19.9

Sources: Ibid.

By 1960, each planning region had lower infant mortality than it had at the previous time period with the exception of C, E, H, K, and O. These latter regions experienced increased rates of infant mortality, except for region O where the rate remained unchanged. There were 8 planning regions with infant mortality in excess of the state rate of

31.7. Of the 8 regions, H was the only one of those regions that had not had infant mortality rates in excess of the state rate consistently since 1940, and all but region K are located in the eastern area of the state. It is also noteworthy that regions C and E no longer had the lowest rates of infant mortality. The range of infant mortality rates among the planning regions had declined to 47 by 1960 from a high of 64 in 1950.

The estimates for 1970 indicate that a decline in infant mortality occurred in each region in the decade of the sixties. The range in infant mortality rates among the planning regions increased slightly from 47 in 1960 to 50 in 1970. This suggests that infant mortality continues to vary considerably from one planning region to another.

Trends and Levels of Infant Mortality Change, 1940-1970

Changes in infant mortality levels for the planning regions were computed in relative and absolute numbers for each decade and are presented in Table 5. The greatest reduction in infant deaths for the regions occurred in the decade of the forties. Planning regions of the state which had the highest levels of infant mortality tended to experience the greatest absolute decline in infant death during the 1940's. These regions were K, M, O, P, Q, and R. On a relative basis, all planning regions experienced pronounced declines in mortality for infants.

In the 1950's, twelve regions showed relative declines in infant mortality, with seven exceeding the state rate of decline (9.7 percent). Of the remaining planning regions, four had relative increases in infant

mortality and one showed no change. Perhaps the most striking feature of changes in infant mortality during the 1950's was the reduction in the magnitude of change compared with change in the 1940's.

Table 5. Absolute and percent change in infant mortality rates for North Carolina planning regions, 1940-1970

Planning Region	1940-50		1950-60		1960-70		1940-70	
	Absolute	Percent	Absolute	Percent	Absolute	Percent	Absolute	Percent
A	-19.9	-39.0	-4.0	-12.9	-5.2	-19.2	-29.1	-57.1
B	-23.5	-42.5	-5.6	-17.6	-1.5	-5.7	-30.6	-55.3
C	-18.1	-40.0	+2.4	+8.9	-1.5	-5.1	-17.2	-38.0
D	-24.5	-46.8	-0.8	-2.9	-3.1	-11.5	-28.4	-54.3
E	-17.9	-40.0	+1.4	+5.2	-3.0	-10.6	-19.5	-43.5
F	-21.9	-40.6	-2.6	-8.1	-7.6	-25.8	-32.1	-59.4
G	-21.8	-42.4	-0.5	-1.7	-7.2	-24.8	-29.5	-57.4
H	-19.8	-37.0	+0.9	+2.7	-2.8	-8.1	-21.7	-40.6
J	-21.4	-39.3	-2.7	-8.2	-10.3	-34.0	-34.4	-63.2
K	-26.8	-40.8	+2.1	+5.4	-13.2	-32.2	-37.9	-57.7
L	-18.4	-28.1	-8.2	-17.4	-10.8	-27.8	-37.4	-57.2
M	-35.8	-51.8	-4.0	-12.0	-6.1	-20.8	-45.9	-66.4
N	-16.8	-25.4	-10.6	-21.5	-11.0	-28.4	-38.4	-58.0
O	-26.1	-41.0	0	-	-15.2	-40.5	-41.3	-64.9
P	-29.6	-42.9	-7.1	-18.0	-8.7	-26.9	-45.4	-65.8
Q	-31.8	-42.0	-3.0	-6.8	-11.1	-27.1	-45.9	-60.6
R	-24.3	-35.8	-7.3	-16.8	-8.5	-23.5	-40.1	-59.1
NORTH CAROLINA	-22.8	-39.4	-3.4	-9.7	-8.0	-25.2	-34.2	-59.1
UNITED STATES	-17.0	-36.4	-3.7	-12.5	-6.0	-20.1	-26.7	-57.2

Sources: Ibid.

North Carolina's infant mortality rate declined by 25.2 percent between 1960 and 1970. This was a greater change than the state experienced between 1950 and 1960 (-9.7 percent). Regions in the eastern geographical areas contributed much to this increased decline in infant mortality. Other regions where infant mortality changed by an amount

greater than the state included regions J (-34.0 percent) and K (-32.2 percent). Nevertheless, all planning regions experienced a decline in infant mortality during the sixties.

The overall change in deaths of infants is also reported for the thirty-year period in Table 5. The absolute changes in infant mortality shown in the fourth column of the table can be interpreted as the reduction in live birth loss over thirty years. For the most part, planning regions in eastern North Carolina experienced above-average reductions in rates of infant mortality while those in the western and Piedmont regions tended to experience below-average reductions. However, it should be mentioned that these latter tended to have below-average rates of infant mortality at the beginning of the thirty-year period, while the former tended to have above-average rates. Yet, all regions experienced significant reductions in the loss of live births during the first year of life over the thirty-year period.

The indices of relative infant mortality for planning regions like those reported previously for counties, are presented in Table 6. These data further outline trends reported in the preceding section. It is interesting to note that planning regions C and E had the lowest indices of relative difference in infant mortality in 1940 and were above the state average in 1970. Another pattern of change is illustrated by Region H whose index of relative difference rose steadily over the thirty-year period such that by 1970, it had the highest index (134) among the planning regions. Region P was the only region with a steady decline in these indices. All the other planning regions have shown erratic patterns in the index of relative difference. Even though there has been an encouraging pattern of health improvement for infants, there is still cause for concern among medical and public health personnel.

Table 6. Indices of relative infant mortality for North Carolina planning regions, 1940-1970

Planning Region	Index Numbers			
	1940	1950	1960	1970
A	88	89	85	93
B	95	91	83	104
C	78	77	93	118
D	90	79	85	101
E	77	77	89	107
F	93	91	93	92
G	89	84	92	92
H	92	96	109	134
J	94	94	96	84
K	113	111	129	117
L	113	134	122	118
M	119	95	92	98
N	114	141	123	117
O	110	107	118	94
P	119	112	102	100
Q	131	125	130	126
R	117	124	114	117
Range	54	64	47	50

Sources: Ibid.

SUMMARY

The major findings of this report are as follows:

(1) Both North Carolina and the United States as a whole experienced sizable reductions in infant mortality in the decade 1940 to 1950. It is also apparent that North Carolina experienced greater gains than the United States during this period, but the rates remained at a higher level.

(2) As compared with the period 1940 to 1950, the decade between 1950 to 1960 produced a much smaller decline in the infant mortality rate, both absolutely and relatively in North Carolina and the United States. The rates for North Carolina continued to exceed those for the country as a whole.

(3) During the past decade, 1960 to 1970, North Carolina as well as the entire United States experienced greater declines compared to the previous decade. The state rate declined from 31.7 in 1960 to 23.7 in 1970. For the same years, the rates for the United States were 25.9 and 19.9 respectively.

(4) Comparing infant mortality in 1940 and 1970 shows that instead of more than fifty infants in each 1,000 dying before their first birthday, less than 25 had died.

(5) During the period 1940 to 1970, considerable variation in infant mortality rates was observed among counties; however, by 1970, the amount of variation was reduced significantly from that which existed in earlier time periods.

(6) Although all counties experienced reductions in rates of infant mortality over the thirty-year period, some exhibited rather erratic patterns. For example, in Cleveland County the infant mortality rate decreased during the 1940-50 decade, increased during the 1950-60 decade, and decreased again during the 1960-70 decade. The state pattern during this time span was one of continued decline.

(7) All multi-county planning regions experienced absolute and relative declines in infant mortality during the period. For the most part, planning regions in eastern North Carolina experienced above-average reductions while those in other areas of the state tended to experience below-average reductions. However, the latter regions tended to have below-average rates of infant mortality at the beginning of the thirty-year period.

(8) From 1940 to 1970, less variation was evident in the multi-county planning regions than for individual counties. The level of variability remained relatively stable for the planning regions through this period of time.

CONCLUSIONS

This report describes trends in infant mortality rates throughout the State of North Carolina between 1940 and 1970. Like the United States as a whole, North Carolina has experienced a marked decline in the loss of infants. Approximately 58 infants for every 1,000 live births died in North Carolina before reaching their first birthday in 1940. By 1970, the infant mortality rate was 23.7 representing a 59 percent reduction over the past thirty years. This change is approximately the same as the reduction in deaths during infancy which the entire United States experienced during the same time period. Yet, the North Carolina rate has remained consistently higher than the United States rate over the thirty-year period.

For people concerned with health-delivery systems throughout North Carolina, differences in the levels of infant mortality and in changing rates of infant mortality from one county to another are very important. The data presented in this report revealed considerable variation in infant deaths in the State of North Carolina, even after thirty years of mortality decline. Thirty-four counties in North Carolina had rates of infant mortality in excess of the North Carolina rate. Considering that North Carolina ranks above the national level of infant mortality, it is apparent that North Carolina as a whole and some of its counties are losing more infants than is necessary. The problem of infant deaths in many counties in 1970 warrants further attention by health officials, nutrition specialists, home economists, and others concerned with public health. On the other hand, fourteen counties have infant mortality

twenty percent or more below the state rate. The characteristics of people in these "healthier" areas and their quality of life could be the focus of subsequent research.

The utilization of the multi-county planning regions eliminates some of the statistical problems involved in comparing infant mortality rates in sparsely populated counties. It also shows variation in live-birth losses which can be used for initiating and administering regional health-delivery systems. The results of the regional analysis indicate considerable variability in levels of infant mortality. The greatest gains appear to have occurred in the counties in the eastern section of the state. Yet, many of these same regions are experiencing the highest levels of infant mortality. In addition, they tend to contain the most rural counties of the state. Perhaps increased health programs and facilities in these and other rural areas of North Carolina may improve the life chances of North Carolina's infants as well as the entire population of the state.

When the infant mortality rate is subdivided into neonatal and post-neonatal mortality, some additional variation is evident as well as pointing to types of infant mortality more amenable to control.[5] Neonatal deaths occur within the first 28 days after birth and are largely dominated by "endogenous" factors such as birth injuries and congenital disorders. In contrast, post-neonatal deaths occur from four to fifty-two weeks and are dominated by "exogenous" or environmental

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[5]Donald J. Bogue, Principles of Demography, New York: John Wiley and Sons, 1969, pp. 560, 588-590.

factors. It is assumed that the latter phase is more responsive to improvements. For example, in 1940, roughly 42 percent of infant deaths were reported as post-neonatal in North Carolina. By 1970, only 27 percent were in this category. It should be noted that both neonatal and post-neonatal mortality declined over the thirty-year period, but with the greatest decline occurring in the post-neonatal category. Apparently post-neonatal mortality has been most responsive to improvements. Further research into this area would provide valuable information for achievement of significant progress in reducing infant mortality.

Finally, it was mentioned earlier that three questions must be addressed in order to provide a complete picture of the health status of a population. This report has identified the existing conditions. Future research can now focus on why the conditions exist and how they can be improved. This will require detailed analyses of the background factors that appear to play an important role in the observed variations in infant mortality. Some of the more obvious factors are race, education, income, occupation, and a variety of environmental variables. It will also be necessary to determine the interrelationships among these variables and their combined impact on infant mortality. For example, the effects of environmental factors such as prenatal care, nutrition, medical attention, cleanliness of homes and neighborhoods and so on are all influenced directly by the locations of persons in the socio-economic class structure. These complex interrelationships ultimately affect the infant's chance of survival.

This line of pursuit would permit an evaluation of the contribution that socio-economic epidemiology, as contrasted with bio-medical epidemiology can make toward the reduction of infant mortality. The

possibility of reducing infant mortality through improved control of social and economic conditions assumes great significance in view of th the deceleration in the rate of decline of the overall infant mortality rate.